PRELIMINARY REPORT

of the

FERGUSON INCIDENT

Prepared By:

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March 24, 2003

EXHIBIT

B

FERGUSON INCIDENT REPORT

ENGINEER'S REPORT MARCH 24, 2003

A. INTRODUCTION

This fall incident occurred on September 7, 2000 at about 10:15 AM at the Allied Systems facility in Moraine, Montgomery County, OH. The incident involved a 1995 Volvo WRGH64 tractor manufactured into an auto transporter by Commercial Carriers, Inc. (CCI) operated by David Ferguson.

Ferguson was in the process of loading the auto transporter and was working in the area above the cab on the driver's side when the incident occurred. Allied Systems Inc employed Ferguson at the time of the incident as a driver.

Post incident inspection of the vehicle revealed that the lower safety cable above the cab on the driver's side had failed.

This investigation was performed to determine if the vehicle and its maintenance were defective in a manner that was a cause of this incident.

I am a full time salaried employee of Robson Lapina. Robson Lapina Charges $ 275 per hour for my time.

B. INFORMATION AVAILABLE FOR REVIEW

1) Deposition of David Ferguson dated 11/21/2002.
2) Deposition of William C Hanes dated 2/12/2003.
3) Deposition of Gary Owen Chinn dated 2/20/2003.
4) Deposition of Richard H. Shivley dated 2/20/2003.
5) Deposition of William C. Weaver dated 2/20/2003.
6) Deposition of Peter J. Terzian, Jr. dated 2/11/2003.
7) Deposition of Frederick L. Wolf dated 2/20/2003.
8) 149 Photographs of the incident and exemplar vehicles.
9) 2 exemplar cables.

10) My inspection and photographs of the exemplar cables.

11) Discovery provided by Allied Systems Inc.

12) Discovery provided by Commercial Carriers, Inc.

13) Discovery provided by Hanes Supply, Inc.

14)Photographs of the scene and vehicle.

15) BWC Incident Report.

C. DESCRIPTION OF THE INCIDENT

The BWC Report States:

> I was loading a vehicle on the top deck head ramp. I was on my knees hooking a chain and when I started to get up I put my left hand on the safety cable and it snapped causing me to fall to the ground.

D. VEHICLE DESCRIPTION

Incident Vehicle

The incident vehicle was a 1995 Volvo tractor that was manufactured into an auto transporter by CCI. The tractor was Allied unit 61304. The trailer was Allied unit 71304.

The tractor a Volvo model WRH64 had the following VIN 4V2PBPF5SR707229.

The auto transporter is a CCI Model 55-2878, Quick 12. The standing surface of the top deck head ramp is about 8 feet 2 inches from the ground.

According to CCI interrogatory answers there is neither an owner's nor is there any maintenance manual for the incident truck and trailer.

CCI drawings indicate that the vehicle was equipped with a total of four safety cables for the top deck head ramp with two mounted on each side. CCI drawing 100340 titled SAFETY CABLE, Attachment A, and reveals the specification for the safety cables they supply with the vehicle. The CCI drawing specifies stud threaded aircraft fittings for their safety cable. The CCI drawing also specifies 1/4 to 5/16 x 7x 19 GAC yellow coated cable. Hanes Supply Inc supplied the cables CCI that were utilized by CCI.

Attachment B is a Hanes Supply invoice which calls for a similar specification of ¼" 7x19 GAC cable coated yellow to 5/16".

Photographs 1 through 46 are various views of the incident and exemplar units as well as exemplar cables. Photographs 1 through 21 and Photographs 45 and 46 were provided.

Photographs 1 through 5 are various views of the incident vehicle and cable taken shortly after the incident. Photograph 1 is a view of the vehicle head ramp and reveals the location of the failed safety cable. The red arrows in Photographs 1 through 5 identify the separated cable and the blue arrows identify the swage fitting the cable separated from.

As can be seen from Photographs 1 through 5, 45 and 46 at the time of the incident there were three safety cables that utilized thimble and eyebolt connections at the ends of the cable. Further, there was one safety cable that utilized stud threaded aircraft fittings that were swaged to the cable.

Photograph 6 through 15 are various views of the incident unit taken about 9/19/2002. Photograph 6 is an overall view of the incident vehicle as viewed from the front right. Photograph 7 is a close-up of the incident cab as viewed from the front left and reveals the incident top deck head ramp.

Photograph 8 is a close-up view of the safety cables above the cab on the driver's side.

Photograph 9 is a view of the vehicles VIN data plate. Photograph 10 is a close-up view of the unit just above the cab on the driver's side and reveals the unit number and CCI model number.

Photograph 11 is a close-up view of a typical safety cable attachment. At the time of this inspection all four safety cables were of the thimble and eyebolt cable connection design.

Photographs 12 and 13 are close-up views of the safety cables and reveal the height of the cables from the top deck head ramp. Further, as can be seen from Photographs 11 through 13 the cables are coated with a clear material and that the cables are not rusty.

Photographs 14 and 15 are close up views of the top deck head ramp's walking surface and reveals the presence of black slip resistant paint.

Exemplar Vehicle

Photographs 16 through 21 are various views of an exemplar auto transporter. Photographs 17 through 21 reveal that there were three safety cables that utilized thimble and eye bolt connections at the ends of the cable. Further, there was one safety cable that utilized stud threaded aircraft fittings that were swaged to the cable. As can

be seen from Photographs 20 and 21 the cable with the stud threaded aircraft fitting is coated with a clear material and that the cables are not rusty. The cable and fitting appear to be made of stainless steel with non-stainless hardware.

First Exemplar Cable

Photographs 22 through 44 are various views of two exemplar cables that I inspected.

The first cable is documented in Photographs 22 through 38. Photographs 22 through 24 reveal that the cable is failed at one end where it would mate with the swaged fitting. This cable is consistent with the CCI/Hanes specification. Further, the failure of the exemplar cable is consistent with the failure of the incident cable.

without the original cable, this is . . .

Photographs 26 through 30 document measurements made of the first exemplar cable. The measurements were taken of the cables outer diameter at the failed end. The measurements reveal that at the failed end the cable has an outside diameter of about .42 inches. Away from the failed end the cable has an outside diameter of about .32 inches. Thus, the cable swelled. Further, the swelling is more pronounced toward the failed end of the cable. The swelling observed is due to the growth of corrosion caused by rusting.

Photographs 32 and 33 are views of the non-failed end of the cable. The photographs reveal that the green painted, yellow coating extends to within about 1/64 of an inch to the swage fitting. Further the photographs reveal the presence of rust. A magnet was utilized to verify that the cable and fitting materials were steel and not stainless steel.

Photographs 34 through 38 are close-up views of the failed end of the cable as viewed looking edge on, down the cable axes. The photographs reveal that the cable is severely rusted. Further inspection of the cable revealed that the failure is consistent with a corrosion induced failure, which will be discussed later in this report. The presence of the swelling observed as noted above confirms this failure mode.

Second Exemplar Cable

Photographs 39 through 44 are various views of the second exemplar I inspected. Photographs 41 through 43 reveal that the cable is not rusty. Further, a magnet was utilized to determine that both the cable and fitting material were stainless steel.

Examination of photographs 42 through 44 reveal that the cable coating is clear in color. Further examination reveals that the stainless steel cable can be readily viewed for inspection purposes through the clear coating.

E. ANALYSIS

Engineering principles applied

In reviewing this case, a number of design and engineering standards of care are pertinent to my analysis that Hanes and CCI not only breached the standard of care, but released their products on the market without sufficient testing and continued to sell their products in the marketplace without required knowledge as to its useful life. Further, there are a number of maintenance standards of care that are pertinent to my analysis that Allied not only breached the standard of care, but released the product under their control to unsuspected users without sufficient testing and continued to use the products in the marketplace even after actual notice of defects.

In general the design, engineering, and maintenance principles that were violated by Hanes include:

a. A manufacturer has a duty to anticipate usage problems, even absent specific notice of problems.

b. Upon actual notice, if the manufacturer fails to address usage problems by warnings, re-writing instructions or design, the manufacturer's behavior is improper.

c. Proper engineering design requires that hazardous conditions be designed out of the product if feasible, and if not, then guarded or warned against.

d. The manufacturer's duty in designing a proper product necessarily includes taking into account the instructions and warnings that accompany that product, as well as the mode of distribution of those instructions and warnings. Proper design of a product requires proper functioning of the instructions and warnings in conjunction with that product. A product's design defects cannot be analyzed without taking into account the accompanying instructions and warnings. Accounting for the accompanying instructions and warnings prior to the first sale is required in determining reasonable expected use.

e. Developing instructions and warnings that meet the standard of care necessarily requires ensuring that the instructions and warnings will reach the consumer through the chain of distribution. A manufacturer cannot assume that instructions not permanently affixed to the product will reach the consumer. Warnings must be conspicuous and designed to last the life of the product. Proper product design requires a designer be competent in the standards for proper communication of necessary instructions and warnings, or the product, instructions, and warnings must be reviewed by someone that is.

f. If the instructions and warning accompanying a product are defective, the product is defective. Further, if the instructions and warning are nonexistent the product is defective.

g. The standard of care for product designers does not allow for the initial testing of instructions in the market place. This testing should be performed, and problems should be corrected, before the product is ever introduced in the market. It is the designer or manufacturer's duty to perform pre-market testing of the product in conjunction with its instructions and warnings before releasing the product into the market. Once the product is in the market, the manufacturer's duty continues. The manufacturer must have a system to track problems with the product or instructions, to review all information received regarding use and misuse of the product and to appropriately respond to safety problems by re-designing the product, re-writing the instructions or creating warnings to ensure its safe use in the marketplace.

h. It is not permissible for a manufacturer to rely on consumers to provide necessary instruction and warnings to the user where those instructions and warnings are essential for safe use of a product. The manufacturer should anticipate retailer, consumer and user confusion and mis-instruction. For that reason, it is essential that the designer of a product incorporate instructions and warnings necessary for safe use into the product itself, and develop a mode of distribution that ensures those instructions and warnings reach the user. Where a manufacturer has provided no hands-on training to a dealer, consumer, or user, that manufacturer can expect nothing in terms of the instructions that the dealer/consumer may or may not provide to it's users. A manufacturer cannot expect a dealer or consumer to provide users with essential instructions and warnings that the manufacturer has not provided to the dealer/consumer.

i. That a defective product has only caused property damage and not physical injury is not an excuse to deny the existence of a defect. The responsibility is on the manufacturer to anticipate dangers flowing from the defect and property damage is a telltale predictor of the danger of physical injury.

j. That it is the absence of adequate warnings and instructions that dictates that the defective conditions be designed out or guarded against.

k. That a manufacturer of an engineered product has a duty to properly consider safety as ANSI writes[1]:

> 8.2.4 In addition to customer needs, the designer should give due consideration to the requirements related to safety, environmental and other regulations, including items in the company's quality policy which may go beyond existing statutory requirements.
>
> 8.2.5 The quality aspects of the design should be unambiguous and adequately define characteristics important to quality, such as the acceptance and rejection criteria. Both fitness for purpose and safeguards against misuse should be considered.

l. Engineers and designers should properly analyze technical developments and their application to their particular industry in order to determine if :

1. The new technology may eliminate a hazard.
2. New technology may eliminate risk associated with accidents.
3. New technology will enhance safety-critical features or assemblies.
4. New technology may be inherently safer.

m. When a firm learns of a safety critical product enhancement, a special effort must be made to not only inform dealers, consumers, and users, of older product, steps must be taken to make that product safe. Further, the company must instruct dealers, customers, and users of the available product improvement, the hazard it eliminates, how to incorporate it, and the hazards of not upgrading.

n. When it is determined that a substantial performance or safety problem exists, notification should be utilized in conjunction with actual field modification of the product itself. The procedure should include:

1. Notification in writing with a product hazard letter as stated above. The company should notify dealers and users by telegram or by certified mail so that the letter is not confused with junk mail and or advertisement and discarded. The message should clearly state the action needed to be taken such as; discontinue use, repair, replace, and so on.
2. Providing dealers and consumers with replacement parts for the program.

3. Develop a plan for evaluating the effectiveness of the notification program, by utilizing available resources such as field service personnel and check-off reporting:

    a. Field personnel including those that provide spare or replacement parts work closely with consumers and users and should be utilized to convey and collect information, such as unsafe practices; unsafe conditions observed; availability of safety device; new literature; apply new safety signs, instructions, and warnings to older machines; upgrade older machines with new devices; and provide safety assessments with service reports; effect consumer and user awareness with both written and verbal information with confirmation in writing.

    b. Check-off reporting should be used to determine the current status of any machine or facility where machines are being serviced. The report should include product identification and the status or presence of safety related items. This report can then be utilized to identify the location of otherwise difficult consumers and users.

o. Manufacturers of products have a duty to design equipment to fail safely. This duty not only includes the actual failure of a component with the product itself but should also include modes of failure of the product to perform its intended function. When a product has an operation characteristic that creates a window of danger or failure mode that could prevent the continued use of the product the manufacturer should make the window of danger or failure safe for users.

p. Manufacturers of products have a duty to design safety devices to outlast the foreseeable life of the product the safety device is designed in conduction with. Further, if the safety device requires maintenance it is the manufacturer's duty to warn and instruct users of the necessary requirements.

q. The Federal Highway Administration (FHWA) requires an annual minimum periodic inspection, which does not form the basis for a PM program. It is merely a once a year requirement that the vehicle meet a set of requirements at the time of inspection. It is not an indication that a vehicle once inspected is safe and sound for part of or the entire upcoming year. The FHWA inspection is one primarily for functionality. It's

not intended to encompass a structural evaluation of the trailer. Further, FHWA under 49 CFR 396.3 requires that:

> Every motor carrier shall systematically inspect, repair, and maintain or cause to be systematically inspected, repaired, and maintained, all motor vehicles subject to its control.

r. Motor carriers are required, by the Federal Motor Carrier Safety Regulations to keep vehicles under their control systematically inspected, repaired, and maintained. The minimal requirements are covered under 49 CFR 396 Parts .1 & .7, and Parts .3, .5,and .17, to .25. The motor carrier is also responsible for ensuring that the driver inspections are properly completed and that drivers are properly trained and "conversant" with all the Parts of the applicable FMCSRs396. The regulation states:

> **§396.3 Inspection, repair and maintenance.**
> (a) **General --** Every motor carrier shall systematically inspect, repair, and maintain, or cause to be systematically inspected, repaired, and maintained, all motor vehicles subject to its control.
> (a)(1) Parts and accessories shall be in safe and proper operating condition at all times. These include those specified in part 393 of this subchapter and any additional parts and accessories which may affect safety of operation, including but not limited to, frame and frame assemblies, suspension systems, axles and attaching parts, wheels and rims, and steering systems.
> (a)(2) Pushout windows, emergency doors, and emergency door marking lights in buses shall be inspected at least every 90 days.
> (b) **Required records --** For vehicles controlled for 30 consecutive days or more, except for a private motor carrier of passengers (nonbusiness), the motor carriers shall maintain, or cause to be maintained, the following record for each vehicle:
> (b)(1) An identification of the vehicle including company number, if so marked, make, serial number, year, and tire size. In addition, if the motor vehicle is not owned by the motor carrier, the record shall identify the name of the person furnishing the vehicle;
> (b)(2) A means to indicate the nature and due date of the various inspection and maintenance operations to be performed;
> (b)(3) A record of inspection, repairs and maintenance indicating their date and nature; and
> (b)(4) A record of tests conducted on pushout windows, emergency doors, and emergency door marking lights on buses.
> (c) **Record retention --** The records required by this section shall be retained where the vehicle is either housed or maintained for a period of 1 year and for 6 months after the motor vehicle leaves the motor carrier's control.

These are among the design principals that I have always designed, and operated by and that all engineers are instructed to utilize where safety is paramount. It is interesting to note that not only are these principles discussed in great detail by the National Safety Council, which states [(2)]:

> To achieve continuous improvement in safety and health, companies must examine the interaction between people and the physical structures in which they work. Designing for safety is a strategy that incorporates a consideration of safety features in all aspects of the workplace environment.

The NSC established a design priority that companies should follow and apply to all design and redesign processes:

First Priority:	Design for minimum risk. (Eliminate hazards)
Second Priority:	Incorporate Safety Devices. (Protective safety design features)
Third Priority:	Provide warning devices. (Warn personnel)
Fourth Priority:	Develop and implement operating procedures and employee training programs. (Train personnel)
Fifth Priority:	Use Personal Protective equipment.

The NSC states that many design situations require a combination of the five priorities but that:

> Companies should not choose a lower level of priority until they have exhausted the practical applications of the higher priority levels. First and second priorities are more effective in safeguarding workers and creating safe systems because they reduce the risk by design measures that eliminate or adequately control the potential of an incident occurring and the severity of its consequences.

The NSC states that 3rd and 4th priorities rely on level of skill of the personnel. Thus, they rely on human intervention and interpretation.

Also the NSC feels that designing safety into equipment is the company's safety professional(s) role due to the fact that designing for safety is not mandatory for many pieces of equipment and operations. The NSC writes:

> Although there are numerous standards, regulations, specifications, design handbooks, and checklists that establish the minimums for specific design subjects, no specific standard clearly describes the principles to be applied in

> designing for safety and the goals to be achieved. The safety practitioners must work to make safety in design part of the company's philosophy and standard operating procedure.

The NSC discusses Proactive versus Reactive design:

> Does a work system encourage employees to take dangerous shortcuts or force them to engage in risky behavior?

And:

> How can a piece of equipment be misused or malfunction, encourage unsafe behavior? Such questions can reveal inherent flaws or hazards that can be corrected by instituting safer designs.

The NSC states that the purpose for having Procedures for Design and Equipment Review is:

> To provide operations, engineering, and design personnel with guidelines and methods to foresee, evaluate, and control hazards related to occupational safety and health and the environment when considering new or redesigned equipment and process systems.

And:

> The design stage offers the greatest opportunity to anticipate, analyze, eliminate, or control hazards.

Shigley and Mischke in their Standard Handbook of Machine Design also discuss the engineering principals in great detail, which is authoritative in the field of engineering on these issues. Shigley writes [(3)]:

> A designer cannot effectively operate in a vacuum, but must know, or be able to discover, information affecting the design, such as the state of the art, the custom of the industry, governmental regulations, standards, good engineering practice, user expectations, legal considerations (such as product liability), and legal design requirements.

With regard to design criteria, Shigley writes:

> Although the general criteria used by a designer are many, the following list addresses almost all concerns:
>
> Function
> Safety
> Reliability
> Cost

Manufacturability
Marketability

With regard to safety Shigley writes:

> Safety This is associated with all modes of product usage. In providing for safety, the priorities in design are first, if possible, to design the hazards out of the product. If this cannot be done, then shielding and guarding should be provided so that operators and by standards cannot be exposed to the hazard. Otherwise, if a risk-benefit analysis shows that production and sale of the machine are still justified (and only as a last resort), effective warnings should be given against the hazard present. Even though warnings are the least expensive and easiest way to handle hazards in the design process, there has never been a warning that physically prevented an accident in progress. Warnings require human action or intervention. If warnings are required, excellent reference sources are publications of the National Safety Council in Chicago and a notebook entitled Machinery Product Safety Signs and Labels.

And,

> The ASME Code of Ethics says: "Engineers shall hold paramount the safety, health and welfare of the public in performance of their duties." This consideration is not new. Tacitus [10.2], about the first century A.D., said: "The desire for safety lies over and against every great and noble enterprise." Even some 2000 years earlier, the first known written law [10.2], while not specifically mentioning safety, clearly implied a necessity for a builder to consider safety.
>
> The National Safety Council [10.3] says:
>
>> Each year, accidental deaths and injuries cost our society in excess of 399 billion-in the United States alone. This figure includes lost wages, medical outlays, property damage and other expenses. The cost in human misery is incalculable. Accidents are the fifth leading cause of death. The council believes that accidents are not just random occurrences but instead result mostly from poor planing or adverse conditions of the environment in which people live, work, drive, and play. In our view, "accidents" nearly always are preventable-as are many illnesses.

Further, incorporating safety and safeguards in the design of machines is discussed in the text book "Industrial Safety" (4):

> Machine builders in general have incorporated into their current models many safeguards that a few years ago were entirely lacking.

And,

> Finally, guards are not makeshift and should not be considered as such. They are designed and built for but one purpose- to protect against a hazard which might cause an injury; and no trouble or expense should be spared in making guards the best that can be made. If the abilities of competent designers are brought to bear on the problems of safeguarding machinery, improvement will be rapid. Anyone who compares the excellence of modern machine design, from the standpoint of effective machine functioning, with that of machine safety, will be impressed by the fact that safety is often treated as though it were of secondary importance. The safety of those who work with our machines must receive more consideration from those who build them.

With regards to mechanical guard requirements Smith notes [1]:

> It must be properly mounted. The mounting must be rigid to prevent objectionable rattles or interference with working parts. The mountings should be strong enough so that they will not fail under use.
>
> It should be easy to inspect, and a periodic checkup program, as part of the maintenance procedure for shop equipment, should be established in order to continue its effectiveness.

With regards to guarding safety hazards Smith writes:

> Fixed guards should be used wherever possible, since they provide permanent protection against hazardous machinery components. Adjustable guards are used when the mode of operation of the machine is expected to change and adjustment will be necessary to accommodate a new set of dimensions. Once adjusted, the guard should function as a fixed guard. Interlocking guards prevent operation of the machine until the guard is moved into position, which keep the worker out of the hazardous zone. It is essential that the guard put the machine in a safe mode if the guard should fail for any reason.

Products such as the incident safety device should be designed to fail safely. Smith writes:

> Fail-safe Designs. Product failures produce a significant fraction of accidents. Fail-safe design seeks to ensure that a failure (1) will not affect the product or (2) will change it to a state in which no injury or damage will occur.
>
> > 1) Fail passive designs reduce the system to its lowest energy level. The product will not operate until corrective action is taken, but the failure-initiating hazard will cause no further damage. Circuit breakers are a good example of fail passive devices.